A Dissertation On

COMPARISON OF BIOMETRIC PARAMETERS IN PRIMARY GLAUCOMAS AND REFRACTIVE ERRORS.

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CERTIFICATE

This is to certify that this dissertation entitled "COMPARISON OF BIOMETRIC PARAMETERS IN PRIMARY GLAUCOMAS AND REFRACTIVE ERRORS" submitted by Dr.A.R.RAJALAKSHMI appearing for Part II M.S Branch III (OPHTHALMOLOGY) degree examination in February 2007 is a bonafide record of work done by her under my direct audience and supervision in partial fulfillment of regulations of the Tamil Nadu, Dr.M.G.R.Medical University ,CHENNAI,TAMILNADU.I forward this to the Tamil Nadu , Dr.M.G.R.Medical University Chennai, Tamil Nadu, India.

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I, **Dr. A.R. Rajalakshmi** solemnly declare that the dissertation titled **"COMPARISON OF BIOMETRIC PARAMETERS IN PRIMARY GLAUCOMAS AND REFRACTIVE ERRORS"** has been prepared by me. This is submitted to The Tamil Nadu Dr. M.G.R. Medical University, Chennai, in partial fulfillment of the requirement for the award of M.S., degree Examination to be held in March 2007.

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COMPARISON OF BIOMETRIC PARAMETERS IN PRIMARY GLAUCOMAS AND REFRACTIVE ERRORS.

DEFINITION:

"Glaucoma is a symptom complex wherein there is optic nerve head neuropathy with characteristic morphological and functional changes of the optic nerve, the major risk factor being increased intraocular pressure."

HISTORICAL BACKGROUND

Although our modern understanding of glaucoma dates back to the mid 19-th century, this group of disorders was apparently recognized by the Greeks as early as 400 BC. In Hippocratic writings, it appears as GLAUCOSIS in reference to the bluish green hue of the affected eye(1). This term, however was applied to a large group of blinding conditions that include cataracts. Although an association with elevated intraocular pressure is found in 10th century Arabian writings, it was not until the 19th century that glaucoma was clearly recognized as a distinct group of ocular disorders.

Von Graefe reported the association of glaucoma with a shallow anterior chamber (2).

Rosengren found that patients with glaucoma had a smaller anterior chamber depth than normal persons. He also suggested that a shallow anterior chamber in acute glaucoma existed prior to acute rise in pressure(3).

Tornquist found the anterior chamber to be genetically determined(4).

SIGNIFICANCE OF GLAUCOMA

Glaucoma is a leading cause of irreversible blindness throughout the world. The World Health Organisation statistics published in 1995, indicate that Glaucoma accounts for blindness in 5.1 million persons or 13.5% of global blindness (behind cataracts and trachoma at 15.8 million and 5.9 million persons or 41.8 % and 15.5 % of global blindness, respectively)

Although Glaucoma most commonly affects the elderly, it occurs in all segments of the society with significant health and economic consequences making it a major public health problem(5). Quigley has estimated that 66.8 million people are affected by primary Glaucoma worldwide, with 6.7 million people being bilaterally blind due to the disease(6).

EPIDEMIOLOGY AND MAGNITUDE

The prevalence of primary open angle Glaucoma versus Primary angle closure glaucoma varies with race and religion. India has a higher prevalence of Primary angle closure glaucoma compared with the Western population (6).

PRIMARY ANGLE CLOSURE GLAUCOMA:

The Andhra Pradesh Eye study(7) had determined the prevalence of manifest PACG (IOP 22 mm Hg , Optic disc damage and visual field loss with narrow angles or gonioscopy) to be 1.08 % in individuals aged over

40.Occludable angles (defined as pigmented trabecular meshwork not visible by gonioscopy in three quarters or more of the angles) was prevalent in 2.21 % in people aged over 40.With a conservative estimate of PACG to be around 0.7 % -1.08 % in adults aged over 40 years about 3 million adult Indians have manifest angle closure glaucoma and another 6 million have occludable angles and are at risk of angle closure . Hence efficient screening measures are mandatory to diagnose PACG early.

PRIMARY OPEN ANGLE GLAUCOMA:

The Andhra Pradesh Eye study(7) had identified the prevalence of POAG to be 1.62 % in those aged over 30 years. The prevalence of POAG increased significantly with age and only 7.4 % of those diagnosed with glaucoma were previously diagnosed and treated. The incidence of glaucoma among the Ocular hypertensives is 1.5 % every year. Since increasing age is a significant risk factor, individuals with the burden of glaucoma would considerably increase in the coming decades due to increase in the life expectancy and the proportion of the geriatric population.

CLASSIFICATION OF GLAUCOMAS:

There are several systems by which the glaucomas can be classified(8). The two most commonly used are based on

1) Etiology - the underlying disorder that leads to an alteration in the Aqueous humor dynamics.

2) Mechanism - the specific alteration in the anterior chamber angle that leads to a rise in the intraocular pressure.

1. CLASSIFICATION BASED ON ETIOLOGY:

The Glaucomas have traditionally been divided on the basis of primary and secondary forms.

a) PRIMARY: Confined to the anterior chamber angle or conventional outflow pathway, with no apparent contribution from other ocular or systemic disorders.

b) SECONDARY: Partial understanding of the underlying predisposing ocular or systemic events.

2. CLASSIFICATION BASED ON MECHANISM:

a) OPEN ANGLE GLAUCOMA: Those in which the anterior chamber angle structures i.e. the trabecular meshwork, ciliary body band are visible by gonioscopy. The elements obstructing the aqueous outflow may be located on the anterior chamber side of the trabecular meshwork (pre trabecular), within the trabeculum or distal to the meshwork in the Schlemm's canal or further along the aqueous drainage system (post trabecular mechanism)

b) ANGLE CLOSURE GLAUCOMA: This includes situations in which the peripheral iris is in apposition with the trabecular meshwork or the peripheral cornea. The peripheral iris may either be pulled (anterior mechanism) or pushed (posterior mechanism) into this position.

c) Developmental anomalies of the anterior chamber angle.

PRIMARY OPEN ANGLE GLAUCOMA :

POAG is a multi factorial syndrome in which acquired progressive optic nerve damage is related at least in part to intraocular pressure higher than the nerve fibres can tolerate. The different types of glaucomas are calculated to be responsible for 15 % of the world's blindness, placing glaucoma as the third leading cause of blindness worldwide(9).

RISK FACTORS:

INTRAOCULAR PRESSURE

The prevalence of POAG increases with increasing intraocular pressure. The risk of glaucoma is greater with progressively higher levels of baseline intraocular pressure. Elevated intraocular pressure is a treatable major cause of development of glaucomatous optic nerve damage; lowering the intraocular pressure may halt or at least inhibit the worsening of glaucomatous optic neuropathy in many patients.

AGE

The prevalence of POAG increases with age. Older people may have greater susceptibility to optic nerve damage than younger people at the same level of IOP.

RACE

The prevalence of POAG is four to five folds greater in blacks than in other races. Blindness from glaucoma is four to eight times more common in blacks than in whites.

FAMILY HISTORY

Family history is a risk factor for glaucoma. The relative risk of having POAG is increased approximately 3.7-fold for individuals who have a sibling with POAG. In the Rotterdam Eye Study, the prevalence was 10.4% in siblings of patients. The same authors estimated that the relative risk of having POAG was 9.2-fold for individuals who have a relative with POAG, and they calculated that the attributable proportion of genetic factors to the overall occurrence of glaucoma in the general population was 16.4%.

MYOPIA

The association between myopia and glaucoma is complex. Glaucoma patients have a higher prevalence of myopia compared with the general population. Myopes also have a greater incidence of glaucoma than non

myopes. A relationship between myopia and increased IOP may suggest that the pressure is the factor influencing the fact that a higher percentage of myopes are affected by glaucoma. One study reported a higher incidence of myopia in POAG patients with normal Intra Ocular Pressure, postulating that a structural problem in the optic nerve or the peripapillary tissue layers in myopia may contribute in some way to vulnerability to pressure even in the normal range

DIABETES MELLITUS

Because Diabetes can compromise the microcirculation of various organs, including the optic nerve, in theory Diabetes could predispose the optic nerve to damage.

OTHER FACTORS

There appears to be a subset of patients with low diastolic perfusion pressures (diastolic blood pressure minus IOP) who are at higher risk for POAG. In studies where the presence of diabetes mellitus is confirmed by physiological indicators, there appears to be an association with POAG. In studies where diabetes mellitus presence is self-reported, there is no detectable association. The association between factors such as concurrent cardiovascular disease, systemic hypertension, and myopia, and POAG has not been demonstrated consistently. Migraine headache and peripheral vasospasm are additional possible risk factors for glaucomatous optic nerve damage.

In addition to the knowledge gained from epidemiological studies and clinical trials about POAG, there are two clinically useful empirical observations:

Past damage predicts future damage, unless the IOP is lowered. Damage in one eye is associated with a significantly increased risk of future damage in the other eye (29% of untreated, undamaged fellow eyes will develop field loss in an average of 5 years).

PRIMARY ANGLE CLOSURE GLAUCOMA

Primary angle closure glaucoma is appositional or synechial closure of the anterior chamber angle caused by papillary block in the absence of other causes of angle closure(9).

RISK FACTORS

Primary angle closure glaucoma is less common than primary open angle glaucoma in most population based studies. Typical acute angle closure is most common in hyperopic women in the late middle age. Although acute angle closure is the most notable event, the various forms of chronic angle closure are far more common.

RACE

Epidemiological data show that in contrast to the predominance of open angle glaucoma among the western populations forms of angle closure

glaucoma predominate among Alaskans Greenland Eskimos Asians and Chinese, Taiwanese and Vietnamese. Angle closure glaucoma is less common among blacks who tend to have the chronic form of the disease.

AGE

Prevalence of Primary angle closure glaucoma increases with age. This finding could be related to the decrease in depth and volume of the anterior chamber which may result from progressive thickening and forward displacement of the lens.

SEX

Acute angle closure develops in women at a rate three to four times more than in men. This higher rate is thought to be due to a significantly shallower anterior chamber in women than in men.

REFRACTION

Hypermetropia is typically found in patients with Primary angle closure glaucoma. The hypermetropic eye tends to have smaller dimensions than the emetropic or myopic eye.

FAMILY HISTORY

The risk of angle closure for first degree relatives is 2% to 5%.

PATHOPHYSIOLOGY OF ANGLE CLOSURE

Eyes predisposed to angle closure glaucoma have certain anatomical characteristics:

- A shallow anterior chamber
- Narrow chamber angles
- A thick lens with a more anterior lens position
- An increased ratio of lens thickness to axial length of the group

Angle closure attacks are typical in the elderly, patients who are hyperopic or nanophthalmic and women rather than men because they have shallow anterior chambers and narrow angles. Lens - Iris apposition partially impedes aqueous flow from the posterior to the anterior chamber (relative pupillary Block). This results in a pressure gradient between the posterior and anterior chambers, which leads to anterior bowing of the peripheral iris. In eyes with shallow anterior chamber angles or narrow anterior chamber angles or with extreme degrees of pupillary block, the anterior bowing may push the iris against the trabecular mesh work. This appositional angle closure may be sufficiently tight to block aqueous outflow, precipitating a rise in intraocular pressure or a frank acute attack. If the attack is not relieved, a permanent closure of the angle results from the formation of peripheral anterior synechiae.

RELATIVE PUPILLARY BLOCK

The most common mechanism leading to angle closure glaucoma appears to be an increased resistance to aqueous flow from the posterior to the anterior chamber between the iris and the lens. An eye with a shallow chamber has a wider zone of contact between the surfaces of the iris and lens. This increases the pressure in the posterior chamber, causing the thin peripheral iris to bulge into the anterior chamber angle.

ANATOMIC FACTORS PREDISPOSING TO PUPILLARY BLOCK

Several anatomical aspects of the eye combine to produce a shallow anterior chamber. These include

- A thicker, more anteriorly placed lens.
- A small diameter, shorter posterior curvature of the cornea
- A shorter axial length of the globe.
- The lens thickness / axial length ratio appears to correlate best with the predisposition to angle closure. It has also been shown that the anterior chamber depth is not a static dimension but can undergo a rapid transient change.

SIGNIFICANCE OF PUPILLARY DILATATION

In mid dilatation, (5 - 6 mm pupil diameter) relative pupillary block increases, resulting in a further rise in pressure in the posterior chamber with movement of the peripheral iris anteriorly in to the angle. Marked dilatation can cause angle closure by jamming the iris into the angle.

BIOMETRIC PARAMETERS

Clinic based studies have suggested that eyes with occludable angles and angle closure glaucoma have a shorter axial length, shallower anterior chamber and a thicker lens (10 – 14). The shallower anterior chambers are in part because of the thicker and more anterior position of the crystalline lens (10). Progressive increase in lens thickness with age results in greater shallowing of the anterior chamber(8).

ANTERIOR CHAMBER DEPTH

The anterior chamber is bound anteriorly by the inner surface of the cornea and posteriorly by the lens centrally, anterior surface of the iris and anterior face of the ciliary muscle peripherally (15). It communicates with the extra cellular space of the iris, ciliary body, trabecular mesh work and with the posterior chamber of the eye through the pupillary aperture. The volume of anterior chamber is approximately 220 microlitres and the average depth is 3.15 mm. the chamber depth decreases by 0.01mm per year of life and is shallower in the hypermetropic than the myopic eye. The diameter of the anterior chamber varies between 11.3 and 12.4 mm.

LENS THICKNESS

The lens of the eye is a transparent, biconvex, elliptical, semisolid, avascular body of crystalline appearance located between the iris and the vitreous. The equatorial diameter of the adult lens is 9 - 10 mm. By direct measurement, its axial sagittal width is about 3.5 - 4 mm at birth, about 4 mm at 40 years and increases slowly to 4.5 to 5 mm in extremes of age. In contrast, its equatorial diameter is 6.5 mm at birth, 9 - 10mm in the second decade and changes little thereafter.

AXIAL LENGTH

The eyeball is made up of two spheres of different sizes placed one in front of the other. The anterior smaller segment is transparent and forms about one sixth of the eyeball. It has a radius of curvature of about 8mm. the posterior larger segment is opaque and forms about five sixth of the eyeball. It has a radius of about 12mm. The antero-posterior diameter of the eye measures about 24mm. Since the eyeball is slightly flattened in a vertical plane, the vertical diameter is about 23mm; the horizontal diameter is about 23 mm,

The larger the antero-posterior diameter of the eye, the more myopic the eye is. Conversely, the shorter the antero-posterior diameter of the eye, the more likely it is that the eye will be hypermetropic.

CENTRAL CORNEAL THICKNESS

The normal cornea has a central thickness of about 0.52 mm and becomes thicker in the paracentral zone (from about 0.52mm inferiorly to 0.57mm superiorly) and peripheral zone (from 0.63mm inferiorly to 0.67mm superiorly). The thinnest zone is about 1.5mm temporal to the geographic centre. The corneal thickness is a sensitive indicator of endothelial physiology that correlates well with the functional measurements such as aqueous flouro-photometry.

Central corneal thickness (CCT) is a risk factor in that it affects accuracy of IOP measurements by all applanation techniques. Corneal thickness above 555 mm produces falsely high IOP readings; corneal thickness less than 540 mm produces falsely low IOP readings. The more the thickness deviates from the range 540 mm to 555 mm, the greater the effect. A thin central cornea (for example, 490 mm) may explain loss of visual field in an eye despite normal applanation IOP measurements because the measurements do not reflect a higher true IOP.

Conversely, a thick central cornea (for example 610 mm) may explain worrisomely high measured IOP associated with longstanding normal visual field and optic disc, due to a lower true IOP.

Ehlers et al extrapolated that applanation tonometry is overestimated or underestimated by approximately 5 mm Hg for every 70 mm difference in

measured CCT from the normal thickness of about 545 mm. Identification of a thin central corneal thickness may support a decision to treat eyes with a normal IOP measurement result. Monitoring without treatment may be justified in eyes with an elevated IOP measurement result and a thick cornea. It is possible that central corneal thickness may itself constitute an intrinsic risk (or protective) factor for glaucomatous optic nerve damage.

DETERMINATION OF CENTRAL CORNEAL THICKNESS

Central corneal thickness is determined in each eye, preferably with an Ultrasound-based electronic pachymeter. Evaluation of corneal thickness aids interpretation of IOP measurement results. Corneal thickness above 555 mm produces falsely high IOP readings, and corneal thickness less than 540 mm produces falsely low IOP readings. The more the thickness deviates from the range of 540 to 555 mm, the greater the effect.

LENS THICKNESS / AXIAL LENGTH FACTOR

In normal eyes and in those with angle closure glaucoma, shallowing of the angle occurs as a dynamic life long process mainly secondary to lens growth. This dynamic situation could actually translate into a direct relationship between the lens volume change and the eyeball volume. This can be further defined as a ratio of lens thickness to axial length. If the lens thickness increases or the eyeball axial length shortens, the angle will become shallower because of forward iris displacement. The lens thickness to axial

length ratio multiplied by 10 provides an index with values of one or more, which we refer to as the lens thickness / axial length factor (LAF) (16). This factor standardises the assessment of eyes with angle closure of glaucoma. It is highly reliable and reproducible and could easily chart the clinical course of the eye examined.

A-SCAN BIOMETRY

Axial length measurement of the eye has become one of the most important functions of ophthalmic ultrasound. The most common use of echography in the eye is the measurement of axial eye length for intraocular lens calculations. In addition, the measurement of axial eye length is useful in differentiating and monitoring certain ocular conditions (17).

PHYSICAL PROPERTIES

Ultrasound is an acoustic wave which consists of an oscillation of particles within a medium. By definition, Ultrasound waves have frequencies greater than 20 KHz which is inaudible to humans. Frequencies used in ophthalmic ultrasound range from 8 – 10 MHz. Very high frequencies produce short wave length (less than 0.2 mm) which allows good resolution of minute ocular structures.

Ultrasound is propagated as a longitudinal wave that consists of alternating compressions and rarefactions of molecules as the wave passes through the medium. Velocity of the ultrasound depends upon the media e.g. Water, which is compressible, transmits the sound waves at a lower velocity

than do more solid media which are less compressible. As a result sound waves travel faster through a solid lens than it does through a liquid vitreous.

MEDIUM	VELOCITY (m/sec)
Water	1480
Aqueous/Vitreous	1532
Soft tissue	1550
Crystalline lens	1641

Ultrasound waves behave like light rays. When longitudinal waves travel through a tissue, a part of the wave may be reflected back towards the source of emitted energy. This reflected wave is referred to as an echo.

ECHOES

Echoes are produces by acoustic interfaces that are created at the junction of two media that have different acoustic impedances. The acoustic impedance of a medium is determined by its sound velocity and its density. Greater the difference in acoustic impedance of two media that produce the interface, stronger is the reflection of the ultrasound wave.

Returning echoes are affected by many factors which include

a) Angle of incidence

b) Size, shape, smoothness of acoustic interfaces

c) Absorption

d) Scattering

e) Refraction

PULSE ECHO SYSTEM

Pulse echo requires the production of multiple short pulses of ultrasound energy with a brief interval between the pulses that allows for returning echoes to be detected, processed and displayed.

Basis of pulse echo system is the piezo-electric element, quartz or ceramic crystal, which is the key component of the ultrasound transducer. The piezo-electric crystal located near the face of the probe undergoes a mechanical vibration when stimulated by electrical energy (i.e. Voltage pulse) from the instrument. The vibration causes a longitudinal ultrasound wave to be propagated through the medium. A pause of several micro seconds then occurs which allows the transducer time to receive the returning echoes. The returning energy creates another mechanical vibration as it strikes the crystal. This vibration produces an electrical signal that is transmitted to the receiver and the display screen. This process of emitting a sound wave alternating with receiving an echo is repeated thousands of times per second to produce a “real time” display.

COMPONENTS OF A-SCAN

A-Scan has three components namely

a) Probe / Transducer

b) Receiver

c) Oscilloscope Display

PROBE / TRANSDUCER

First generation of contact biometers used water filled probes with a soft membranous tip. Current biometers use a solid probe that requires less maintenance and avoids many of the problems inherent in water filled probes. Solid tip probe can more easily indent the cornea, resulting in shortened axial length reading. Nevertheless, in most cases the experiences examiner can learn to apply the probe with minimal pressure, there by preventing corneal compression.

Another important component of ultrasound probe is the damping material which is attached to the back of the crystal. It limits the vibration of the crystal that produces the pulses of ultrasonic energy, thus shortening the pulse and increases the resolution of the ultrasound system. Axial resolution is the minimum distance between two interfaces (echo sources) along the direction of the sound beam that can be displayed. Shorter the pulse, better the axial resolution.

RECEIVER

Following transducer excitation, echoes from the ocular and orbital interfaces impinge upon the transducer. The voltage pulses generated in response to these ultrasonic echoes must be modified which includes amplification, compensation, compression, demodulation and rejection before they can be displayed in a useful format. The required modifications are carried out by an electronic receiver.

A receiver can also incorporate additional processing techniques such as time-varied gain to compensate for tissue absorption. Another common feature employed in receiver is the electronic rejection of signals under a certain threshold level so that noise and small extraneous signals are not displayed.

OSCILLOSCOPE DISPLAY

After being processed by the receiver, echo voltages are displayed on an oscilloscope. Oscilloscope contains a display tube with a phosphorescent screen which glows when struck by an electron beam emitted from a gun at the base of the tube. Horizontal and vertical movement of the electron beam is controlled by voltages applied to deflection plates. Horizontal deflection plates are supplied with a voltage and vertical with processed video signals. These simultaneous operations sweep the electron beam over the oscilloscope screen yielding the desired graphic display.

TECHNIQUES IN AXIAL LENGTH MEASUREMENTS

Accuracy of axial length measurement is within 0.1 mm. Two techniques of measuring axial length with A-Scan ultrasound are

a) Contact Technique

b) Immersion Technique.

In both the techniques, the sound beam is directed along the optical axis of the eye. Majority of biometric A Scan instruments are digitalized which allows individual echograms to be stored. Most of the machines have a foot pedal that is depressed to freeze a given scan.

Some biometers can be used with either contact or immersion techniques where as others are designed for use with only the contact method. Documentation of measurement can be accomplished with a photograph of echogram. Many of these biometers are programmed with several different formulae to facilitate calculation of intra ocular power.

1. CONTACT TECHNIQUE

In contact technique probe is placed directly on cornea and sound beam is directed along the optical axis. This can be performed by holding the probe with the hand or by applanation. With hand held technique, the patient is normally seated in an upright position.

In applanation method, probe is mounted in a pressure sensitive, spring loaded sleeve on a slit lamp or a similar apparatus. Patients head is positioned in the chin rest and the joystick is slowly advanced until the probe touches the center of the cornea. As soon as the measurement is obtained, the probe is removed and patient is encouraged to blink. Three to five high quality consistent measurements (within 0.3 mm) are taken.

SOURCES OF ERROR WITH CONTACT METHOD

One millimeter error in axial length can result in 2.5 to 3.0 diopter error in post operative refraction. Primary sources of error include corneal compression, fluid meniscus between probe and cornea, misalignment of sound beam. Corneal compression results in shortened axial length measurement. Fluid meniscus trapped between tip of the probe and the cornea, may result in falsely long reading. In some cases, misalignment of sound beam can occur with contact method resulting in a significant error.

2. IMMERSION TECHNIQUE

This method employs a smaller water bath so that the probe is not placed directly on the cornea. This allows display of separate corneal spike that is not seen with contact method. Patient is typically reclined. After topical anesthetic drops, a small plastic cylinder (scleral shell) is inserted between the lids and is filled about 2/3rd full of methyl cellulose. Patient fixates on a target in primary gaze and probe is immersed into the fluid.

Beginning at a high gain setting, steeply rising, high reflective spikes are displayed from the interfaces namely cornea, anterior and posterior lens surface and retina. As the gain is turned upside down, displayed spikes decrease in height and ensure that all spikes remain as high and distinct as possible. 3 high quality echograms ranging within 0.3mm should be obtained.

ADVANTAGES AND DISADVANTAGES OF IMMERSION TECHNIQUE

1. Examiner should be cautious when using immersion technique in eyes with recent intra ocular surgery or penetrating trauma.

2. Primary advantage of immersion technique over contact method is that corneal compression does not occur during the examination. This is of particular importance in patients with short axial lengths where small errors in measurement can lead to significant error in post operative refraction.

3. Problem of fluid meniscus occurring between probe tip and cornea is avoided with this technique. Display of separate cornea spike makes it easier to determine when the sound beam is properly aligned along the optical axis.

DIAGNOSTIC USES OF AXIAL LENGTH MEASUREMENT

a) Helpful in diagnosis and monitoring of certain conditions, e.g. microphthalmos, nanophthalmos, axial myopia, congenital glaucoma, phthisis bulbi.

b) Calculation of IOL power.

PACHYMETER

Pachymeter is the instrument used to measure the corneal thickness. Ultrasonic Pachymeter uses 20 MHz ultrasound for the measurement of corneal thickness. Higher frequency is ideal for differentiating corneal boundaries from other ocular structures because of better resolution. A corneal pachymeter can be optical or ultrasonic. Optical pachymetry can be performed using a device that attaches to the slit lamp biomicroscope, but it is somewhat imprecise. Ultrasonic pachymetry is both easier and more accurate. Instrumentation is based on the speed of the sound in the normal cornea. Improved signal processing and other methods such as laser interferometry allow the examiner to map the corneal thickness very precisely(18).

PRINCIPLE

The operating principle is based on timing the reflection of sound from the structures of interest. For corneal pachymetry, the time taken for sound to travel from the measuring probe in contact with the cornea to the anterior chamber interface and back is of interest. The direction of the ultrasonic beam is aligned with the visual axis.

The ultrasound pachymeter probe tip is placed on the surface of the cornea. Ultrasound waves are emitted and detected by the probe. The computation of the corneal thickness is based on the speed with which the sound travels through the cornea. The thickness is measured by the time

interval between the anterior and posterior corneal surfaces. This measurement is calibrated based on the speed of sound in cornea and converted into micro meters.

COMPONENTS OF ULTRASOUND PACHYMETER

There are three major components of any ultrasound pachymeter

a) The probe handle with its transducer and tip

b) The housing of the instrument

c) Accessories and convenience features

PROBE HANDLE

The ultrasound mechanism is contained in the pachymeter probe handle. All probes are hand held, smaller and lighter, easier to use clinically. Angled probe handles allow better visualization of the tip so as to ensure perpendicular application on the corneal surface.

TRANSDUCER

The transducer sends the beam of ultrasound waves through the probe tip into the cornea and receives them in return. A wide probe tip and a wide transducer beam reduce the accuracy of the corneal thickness reading at a single point.

PROBE TIP

The probe tip is the interface between cornea and the transducer. The transducer focuses the beam at a point beyond the probe tip. The internal steepness of the walls, the probe diameter and its configuration all contribute to the internal reflection of the beam and its ultimate focusing point. Therefore the material in the probe tip should not attenuate the ultrasound beam. The diameter of the tip should be 2mm or less to diminish the area over which the ultrasound beam is spread and to allow the observer to see exactly where the tip is placed in the cornea. The surface of the tip should be smooth so that the corneal surface is not damaged.

The tip is required to be held within 10 degree from the normal of the cornea before a reading is given. The reading is based on an averaged series of values computed by the instrument. The readings are accurate up to 5-10 µ. The most frequent number is measured as the corneal thickness.

USES OF CORNEAL PACHYMETRY

Corneal pachymetry can aid in the diagnosis of corneal thinning disorders and can also be used to assess the function of the corneal endothelium. A higher central corneal thickness greater than 0.65 mm suggests a higher risk for symptomatic corneal edema after intra ocular surgery. Corneal thickness can also affect the measurement of intraocular pressure with goldmann applanation tonometry.

AIM OF THE STUDY

- To compare the ocular biometric values in primary open angle glaucomas with myopic and hypermetropic refractive errors.

- To analyse statistically the strength of association and predictability of the biometric parameters for the occurrence of primary angle closure glaucoma.

PURPOSE OF THE STUDY

Angle closure glaucoma is commoner in India than in the west, the reasons for which are not clearly understood. There is evidence in the literature that the eyes with angle closure glaucoma have a definite recognisable anatomical predisposition.

MATERIALS AND METHODS

This is a prospective study done in Glaucoma Clinic - Regional Institute of Ophthalmology and Government Ophthalmic Hospital, Chennai between February 2005 and May 2006. A total of hundred patients were randomly selected. Informed consent was obtained from all the patients. The patients were divided into two groups of fifty each namely group A and group B.

GROUP A - PRIMARY GLAUCOMA GROUP

A total of fifty patients were randomly selected from those who attended the glaucoma clinic during the study period. 25 of them were primary open angle glaucoma with increased intra ocular pressure on one or more occasions and optic nerve head and / or visual field changes, open angles on gonioscopy by shaffers grading. The remaining twenty five patients were primary angle closure glaucoma with history of pain with or without redness, diminision of vision, colored haloes, increased intraocular pressure gonioscopically narrow angle of anterior chamber without any evidence of secondary cause of raised intraocular pressure.

GROUP B - REFRACTIVE ERROR GROUP

All the patients of this group were also randomly selected from those listed for refraction in the out patient department during the study period. Twenty five patients were with myopic refractive status and the remaining with hypermetropic errors.

SELECTION CRITERIA FOR GROUP A

INCLUSION CRITERIA

1. Proven cases of primary open angle and angle closure glaucoma only on medical treatment.

2. Age group between 31 and 50

3. Uncorrected visual acuity 6/12 or better.

EXCLUSION CRITERIA

1. Cases of primary open angle and angle closure glaucoma with previous surgical or laser treatment for glaucoma.

2. Other secondary causes of glaucomas

3. NTG / Glaucoma Suspects / OHT

4. Congenital glaucomas

5. Other ocular / systemic diseases

6. Patients with significant lens changes and refractive errors

SELECTION CRITERIA FOR GROUP B

INCLUSION CRITERIA

1. Age group between 11 - 30 years

2. Refractive Error

Spherical +/- 6

Cylindrical +/- 4

EXCLUSION CRITERIA

1. High refractive errors

2. Ocular anomalies

3. History of trauma or intra ocular surgeries

4. History of medical or systemic illness

5. Strabismus / Keratoconus

All subjects underwent a complete ocular examination including visual acuity measurement Refraction, Slit lamp examination, Goldmann applanation tonometry, Gonioscopy with Goldmann single mirror. Direct and indirect ophthalmoscope examination, stereo biomicroscopic examination of the optic disc using +90D lens. Gonioscopy was performed with Goldmann's Single mirror in dim illumination using a shortened slit beam that did not fall upon the pupil. The Shaffer grading system was used for grading the patients.

Biometric measurements were taken using the contact ultrasonography method with the Biomedix echorule 2 A-Scan Biometer. A drop of local anesthetic is instilled with the patient in semi reclined position. The patient is instructed to gaze steadily with the eyelids wide open. The handheld probe is then placed perpendicularly on the cornea.

The horizontal dimension of the display screen is proportional to time and calibrated to distance measurement. The vertical deflections from this line depict the position of an echo while the height of the vertical deflection is proportional to echo intensity. A built in tissue recognition pattern unit allows measurement and instant display of axial length, lens thickness and anterior chamber depth. Central corneal thickness of all the patients was measured with the Sonomed Micropach model 200P ultrasonic pachymeter.

The patient is made to sit inclined and asked to fix a point in distance along the central position of gaze. The readings are taken covering the central cornea by placing the probe over the centre of the pupil. The probe is handheld and placed to ensure perpendicular corneal contact. Care is taken to avoid excessive corneal compression.

Three consecutive measurement of each feature was recorded. Al the measurements were taken by a single trained person to avoid inter - observer variability. The measurements were taken for both the eyes and the mean of the three recording were used as the final value for both the A-Scan biometry and ultrasonic pachymetry.

RESULTS

GROUP – A

PRIMARY OPEN ANGLE GLAUCOMA

AGE AND SEX DISTRIBUTION

The number of males in POAG was 15 and the number of females was 10. 15 of the total 25 patients were within 41-50 yrs age group and the remaining 10 in 31-40 yrs age group

SEX DISTRIBUTION

MALE	15
FEMALE	10

AGE DISTRIBUTION

AGE IN YEARS	NO: OF EYES
31 – 40	10
41 – 50	15

CENTRAL CORNEAL THICKNESS

The average CCT was 548.36 ± 24.75µ in this group of 50 eyes, out of which 36 eyes showed a value ranging from 501-550µ. 12 eyes had central corneal thickness between 551-600µ and only two eyes measured more than 600µ.

THICKNESS IN MICRONS	NO: OF EYES
<501	Nil
501 – 550	36
551 – 600	12
>600	2

ANTERIOR CHAMBER DEPTH

The ACD ranged from 3.00 – 3.50 mm in 12 eyes, 3.26 – 3.50 mm in 28 eyes, 3.51 – 3.75 mm in 7 eyes and more than 3.76 mm in 3 eyes. The average ACD was 3.39 mm ± 0.20.

DEPTH IN MM	NO: OF EYES
3.00 – 3.25	12
3.26 – 3.50	28
3.51 – 3.75	7
3.76 – 4.0	3

LENS THICKNESS

The LT of this group showed an average value of 3.79 ± 0.19 mm, 22 eyes measured within 3.51 – 3.75 mm followed by 21 eyes within 3.76-4.00 mm and the rest 7 eyes measured > 4.00 mm.

THICKNESS IN MM	NO: OF EYES
< 3.50	Nil
3.51 – 3.75	22
3.76 – 4.00	21
> 4.00	7

AXIAL LENGTH

The mean AL of this group of 50 eyes was 23.12 ± 0.35 mm, 26 eyes had an AL greater than 23.00 mm. Out of the remaining 24 eyes, 20 eyes showed AL to be within 22.76-23.00 mm and 4 eyes within 22.50 – 22.75 mm.

LENGTH IN MM	NO: OF EYES
<22.50	Nil
22.50 – 22.75	4
22.76 – 23.00	20
> 23.00	26

LENS THICKNESS – AXIAL LENGTH RATIO

In this group of 50 eyes, the LT/AL ratio showed a mean value of 1.64 ± 0.09. 42 eyes showed the LT/AL ratio to be within 1.51 -1.75, 7 eyes were >1.75 and only one eye was <1.50.

	NO: OF EYES
1.25 – 1.50	1
1.51 – 1.75	42
> 1.75	7

PRIMARY ANGLE CLOSURE GLAUCOMA

AGE AND SEX DISTRIBUTION

Among the 25 PACG patients there were 12 males and 13 females. In the 41-50 yrs age group 15 patients were studied and the remaining 10 were in the 31-40 yrs age group

SEX DISTRIBUTION

MALE	12
FEMALE	13

AGE DISTRIBUTION

AGE IN YEARS	**NO: OF PATIENTS**
31 – 40	10
41 – 50	15

CENTRAL CORNEAL THICKNESS

THICKNESS IN MICRONS	**NO: OF EYES**
< 501	3
501 – 550	27
551 – 600	16
> 600	4

The total number of eyes studied were 50 out of which 27 eyes had a corneal thickness in the range of 501-550 microns.3 eyes had a CCT < 501 microns and 4 eyes had a CCT>600 microns. The remaining 16 eyes were measured to have a CCT with in 551-600 microns. The average CCT was found to 544.72 microns ± 31.47.

ANTERIOR CHAMBER DEPTH

DEPTH IN MM	NO: OF EYES
< 2.01	1
2.01 – 2.25	35
2.26 – 2.50	13
> 2.50	1

Of the 50 eyes studied, 35 eyes had an AC depth of 2.01-2.25 mm, 13 eyes were with in 2.26 – 2.50 mm. Only one eye was <2.01 mm and one eye >2.50 mm. The mean ACD in mm in this group was 2.20 ± 0.13

LENS THICKNESS

THICKNESS IN MM	NO: OF EYES
4.26 – 4.50	10
4.51 – 4.75	38
> 4.76	2

The lens thickness was more in this group of 38 eyes measuring 4.51-4.75mm followed by 10 eyes in 4.26 – 4.50 mm. The remaining 2 eyes measured >4.76 mm. The average LT was 4.60mm ± 0.12.

AXIAL LENGTH

LENGTH IN MM	NO: OF EYES
21.75 – 22.00	16
22.01 – 22.25	27
22.26 – 22.50	7

The mean AC in this group was 22.07mm ± 0.18. 27 eyes of total 50 eyes had axial length within 22.01 – 22.25 mm, 16 eye showed axial length of 21.75-22.00 mm and 7 eyes had axial length 22.26 – 22.50 mm.

LENS THICKNESS – AXIAL LENGTH RATIO

	NO: OF EYES
< 2.00	6
2.01 – 2.25	44

44 eyes showed LT/AL ratio of 2.01-2.25 only 6 eyes showed <2.00. The average LT/AL ratio was 2.08 ± 0.06.

GROUP - B

MYOPES

AGE AND SEX DISTRIBUTION

Among the 25 myopic patients studied, 14 were males and 11 were females. 10 of them were within the 11 – 20 age groups and the remaining 15 in 21 – 30 age groups.

SEX DISTRIBUTION

MALE	14
FEMALE	11

AGE DISTRIBUTION

AGE IN YEARS	NO: OF EYES
11 – 20	10
21 – 30	15

CENTRAL CORNEAL THICKNESS

THICKNESS IN MICRONS	NO: OF EYES
< 501	Nil
501 – 550	25
551 – 600	23
> 600	2

The CCT was measured for 50 eyes of 25 patients. Half of them had a value in the range of 501 – 550 microns. Only 2 eyes had a corneal thickness of more than 600 microns.

ANTERIOR CHAMBER DEPTH

Most of the eyes had an ACD ranging from 3.26 to 3.50 mm with only one being in the range of 3.76 and 4.00.

DEPTH IN MM	NO: OF EYES
3.00 – 3.25	5
3.26 – 3.50	28
3.51 – 3.75	16
3.76 – 4.00	1

LENS THICKNESS

Maximum number of eyes had lens thickness within 3.26 to 3.75 mm. The average lens thickness was 3.5 mm.

THICKNESS IN MM	NO: OF EYES
3.00 – 3.25	0
3.26 – 3.50	26
3.51 – 3.75	22
3.76 – 4.00	2

AXIAL LENGTH

The average axial length of the myopic patients was found to be 23.72 ± 0.20 mm. The axial length of 22 eyes was within 23.51 to 23.75 mm. 14 eyes had an axial length between 23.76 – 24.00 mm and 5 eyes measured greater than 24.00 mm.

LENGTH IN MM	NO: OF EYES
23.25 – 23.50	9
23.51 – 23.75	22
23.76 – 24.00	14
>24.00	5

LENS THICKNESS – AXIAL LENGTH RATIO

The LT/AL ratio was within 1.25 – 1.50 in 35 eyes (70 %) and the rest was more than 1.51. The average LT/AL ratio in this group was 1.47 ± 0.06

	NO: OF EYES
1.25 – 1.50	35
1.51 – 1.75	15

HYPERMETROPES

AGE AND SEX DISTRIBUTION

Of the 25 hypermetropic patients studied, 11 were males and 14 were females. Only 8 of the total 25 patients were in 11-20 years age group and the rest 22 were within 21-30 years age group.

SEX DISTRIBUTION

MALE	11
FEMALE	14

AGE DISTRIBUTION

AGE IN YEARS	**NO: OF EYES**
11 – 20	8
21 – 30	22

CENTRAL CORNEAL THICKNESS

THICKNESS IN MICRONS	NO: OF EYES
< 501	Nil
501 – 550	30
551 – 600	20
> 600	Nil

The average CCT of the hypermetropes was 545.08 ± 21.80 microns with all 50 eyes falling between 501-600 microns, 30 eyes ranged from 501-550 microns and the rest 20 eyes from 551-600 microns.

ANTERIOR CHAMBER DEPTH

DEPTH IN MM	NO: OF EYES
< 2.50	Nil
2.50 – 2.75	15
2.76 – 3.00	33
3.01 – 3.25	2

The anterior chamber depth of this group of 50 eyes showed an average of 2.82 ± 0.11mm. The ACD was within 2.76-3.00 mm in 33 eyes followed by 15 eyes within 2.50-2.75 mm.

LENS THICKNESS

THICKNESS IN MM	NO: OF EYES
< 4	7
4.01 – 4.25	15
4.26 – 4.50	28

This group showed an average LT of 4.22 ± 0.15 mm. The lens thickness was between 4.26 – 4.50 mm in 28 eyes, 4.01-4.25 mm in 15 eyes and <4.0 mm in 7 eyes.

AXIAL LENGTH

LENGTH IN MM	NO: OF EYES
21.75 – 22.00	4
22.01 – 22.25	23
22.26 – 22.50	23
> 22.50	Nil

The average AL in this group was 22.22 ± 0.14 mm. 46 eyes had AL from 22.01 – 22.50 and only 4 eyes had axial length < 22.01. None of the eyes had axial length more than 22.50 mm.

LENS THICKNESS – AXIAL LENGTH RATIO

	NO: OF EYES
1.51 – 1.75	1
1.76 – 2.00	49

Only one eye had LT / AL ratio < 1.76 and the rest 49 eyes showed LT/AL ratio between 1.76 and 2.00. The mean LT/AL ratio was 1.90 ± 0.07.

DISCUSSION

The overall results of the both groups are tabulated below. The average measurements of the biometric parameters among the glaucoma patients showed that the PACG patients have a small anterior chamber, thicker lens and a shorter axial length than the POAG patients. A similar comparison among the refractive error group showed that the Hypermetropic patients have a small anterior chamber, thicker lens and a shorter axial length when compared to the myopic patients.

GROUP A

BIOMETRIC PARAMETERS	**POAG**		**PACG**	
	MEAN	**S D**	**MEAN**	**S D**
C C T (µ)	548.36	24.71	544.72	31.47
A C D (mm)	3.39	0.20	2.20	0.13
L T (mm)	3.79	0.19	4.60	0.12
A L (mm)	23.12	0.35	22.07	0.18
L T / A L	1.64	0.09	2.08	0.06

GROUP B

BIOMETRIC PARAMETERS	MYOPES		HYPERMETROPES	
	MEAN	**S D**	**MEAN**	**S D**
C C T (μ)	550.92	19.27	545.08	21.80
A C D (mm)	3.44	0.16	2.82	0.11
L T (mm)	3.50	0.14	4.22	0.15
A L (mm)	23.72	0.20	22.22	0.14
L T / A L	1.47	0.06	1.90	0.07

The student's t test for independent samples was used to compare statistically and analyse the significance of association of the two groups. The results are as follows.

MYOPES AND POAG

The lens thickness, axial length and the Lens thickness / axial length factor (LAF) showed high statistical significance with a p value less than 0.001 significant at 1% level. The anterior chamber depth and central corneal thickness among the two groups did not show statistical significance.

HYPERMETROPES AND PACG

The two groups showed a high statistical significance at 1% level with p value less than 0.001 for the following biometric parameters namely lens thickness, anterior chamber depth, axial length and the lens thickness / axial length factor. There was no statistical association of central corneal thickness among the two groups.

Angle closure glaucoma is commoner in India than in the west. The exact reason for this is not clearly understood. On comparing the axial length, the anterior chamber depth and lens thickness among the PACG and hypermetropes, it is found to be statistically significant. Marcowitz SN, Morin JD have shown the anatomical predisposition of patients with PACG in which they have studied ultrasonographic biometric measurements. Their analysis showed an apparently abnormal pattern of growth of the lens, its thickness increasing at an accelerated rate between 4^{th} and 6^{th} decades (16). A similar population based study of ocular biometry by George R, Paul PG et, al., have shown that south Indian eyes with angle closure glaucoma and occludable angles seemed to have significantly shorter axial lengths, shallower anterior chambers and greater lens thickness compared to the normal group (19).

Sihota R, Gupta V et, al., have concluded in their study that the ocular parameters of asymptomatic or creeping angle closure eyes were significantly different from eyes having POAG. Open angle glaucoma and normal eyes

were comparable, but different from angle closure group in having a deep anterior chamber, thicker lens and longer axial length (11).

Caprioli J, Spaeth G L et, al have shown that AC Depth is a function of sex age and refractive error (20).

The LAF of the PACG in this study was 2.08 ± 0.06. a similar result of 1.87 ± 0.11 in 30 – 39 age group and 2.08 ± 0.61 was found in the study of Markowitz et, al., (16)

The lens thickness / axial length factor in patients with PACG proved to greater than normal (30 – 39 years age group 1.83 ± 0.3 / 40 – 49 years age group 1.9 ± 0.32) for that group. A similar result was seen in the hypermetropic patients in this study.

CONCLUSION

- Primary angle closure glaucoma seems to be associated with shallower anterior chambers, thicker lenses and shorter axial length.

- The basic biometric parameters namely the anterior chamber depth, lens thickness, the axial length and the lens thickness / axial length ratio of the hypermetropes show a strong and significant association when compared with the Primary angle closure glaucoma patients.

- Lens thickness / axial length factor standardizes the assessment of the eyes with angle closure glaucoma. It is highly reliable and reproducible and easily chart the clinical course of the eye examined.

- As ultrasonography is now a commonly done office procedure, measurements of axial length, lens thickness, and the anterior chamber depth could be done routinely as part of screening to predict the eyes that may go in for angle closure glaucoma.

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PROFORMA

NAME: OP / IP NO:

AGE: GLAUCOMA CL. NO:

SEX: MALE / FEMALE DATE:

ADDRESS:

OCCUPATION:

GENERAL HISTORY:

DIABETIC

HYPERTENSIVE

CARDIO VASCULAR / CEREBRO VASCULAR

OTHER SYSTEMIC ILLNESS

PRIOR NON-OCULAR SURGERY

CURRENT SYSTEMIC MEDICATIONS / DRUG ALLERGIES

FAMILY HISTORY OF GLAUCOMA

PERSONAL HISTORY: SMOKER / ALCOHOLIC

OCULAR HISTORY:

PRESENTING SYMPTOMS: DEFECTIVE VISION / FIELD DEFECT / ROUTINE SCREENING

AGE OF ONSET / DURATION OF COMPLAINTS:

	RE	**LE**
DEFECTIVE VISION		
HEAD ACHE		
EYE PAIN		
REDNESS		
FIELD EFFECT		
COLOURED HALOES		
HISTORY OF FREQUENT CHANGE OF GLASSES:		
EPISODES OF BLURRED VISION:		
H/O OCULAR TRAUMA		

H/O PREVIOUS EYE DISEASE OR SURGERY:

H/O PROLONGED USE OF STEROIDS [TOPICAL / SYSTEMIC]:

PREVIOUS TREATMENT:

PRESENT TREATMENT:

EXAMINATION:

GENERAL EXAMINATION:

GENERAL CONDITION:

PULSE: BP:

OCULAR EXAMINATION:

	RE	**LE**
VISUAL ACUITY (BY SNELLEN'S):		
WITH PIN HOLE:		
REFRACTION:		
NEAR VISION:		
LIDS:		
CONJUNCTIVA:		
CORNEA:		
ANTERIOR CHAMBER:		
IRIS		
PUPIL		
LENS		
GONIOSCOPY SHAFFERS		
INTRA OCULAR TENSION APPLANATION:		

FUNDUS:

DISTANT DIRECT

DIRECT:
DISC: SIZE

SHAPE

MARGIN

COLOUR

CUP: DISC RATIO

VESSELS

NEURO RETINAL RIM:

LAMINAR DOT SIGN:

NASAL SHIFT OF VESSELS:

BAYONETTING:

PRESENCE OF HAEMORRHAGES:

NERVE FIBRE LAYER:
NORMAL / WEDGE DEFECT / DIFFUSE / ATROPHY

MACULA:

OTHER FINDINGS:

FIELD TESTING:

MANUAL: BJERRUM'S KINETIC

AUTOMATED PERIMETRY:

BIOMETRIC PARAMETERS:

CORNEAL THICKNESS:

ANTERIOR CHAMBER DEPTH:

LENS THICKNESS:

AXIAL LENGTH:

L A F

KEY TO MASTER CHART

R Sph	-	Refraction sphere in diopters
R Cyl	-	Refraction cylinder in diopters
V / A	-	Visual acuity
IOP	-	Intra ocular pressure in mm of Hg
CCT	-	Central corneal thickness in µ.
ACD	-	Anterior chamber depth in mm
LT	-	Lens thickness in mm
AL	-	Axial Length in mm
LT / AL	-	Lens thickness – Axial length ratio

LIST OF SURGERIES :

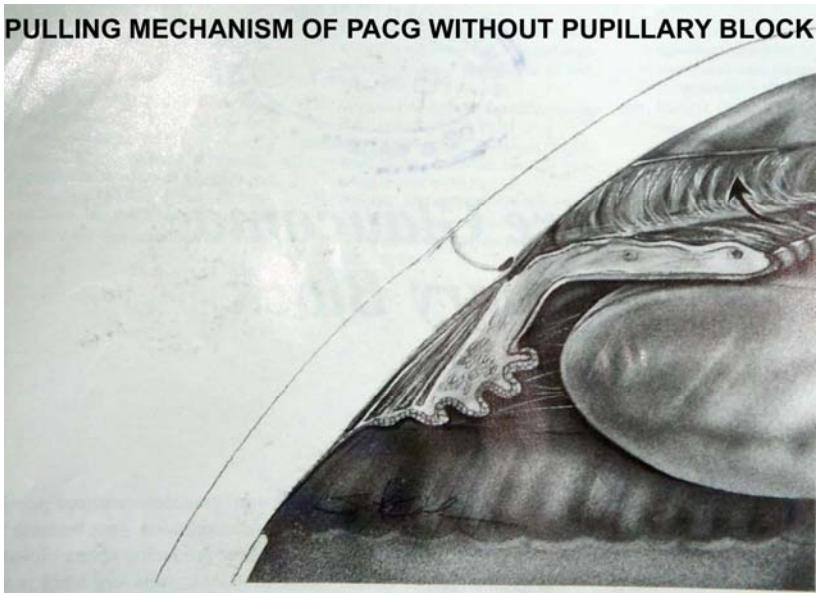
S. No	NAME	AG/SX	IP NO	DIAGNOSIS	D. O. S	PROCEDURE
1.	GOPAL	65/M	382619	RE – IMC	10.07.04	RE-ECCE/PCIOL
2.	PARVATHI	58/F	382759	BE–IMCL>R	17.07.04	RE-ECCE/PCIOL
3.	KAMSALA	50/F	382947	BE–IMCL>R	31.07.04	LE-ECCE/PCIOL
4.	SULOCHANA	60/F	390756	BE–IMCR>L	27.04.05	RE-ECCE/PCIOL
5.	BABU	53/M	391787	BE-IMC R>L	10.05.05	RE-ECCE/PCIOL
6.	KRISHNAVENI	70/F	393782	RE – MC	12.07.05	RE-ECCE/PCIOL
7.	SAVITHRI	58/F	390999	BE–IMC R>L	18.08.05	RE-ECCE/PCIOL
8.	SUSAI	59/M	396179	LE – IMC	03.10.05	LE-ECCE/PCIOL
9.	ANANDAN	65/M	399979	RE – IMC	08.11.05	RE-ECCE/PCIOL
10.	NARAYANAN	70/M	392147	LE – IMC	25.01.06	LE – SICS/PCIOL
11.	VELUSAMY	52/M	392436	BE–IMC L>R	01.02.06	RE – SICS/PCIOL
12.	MUNIAMMAL	65/F	399423	BE-IMC L>R	15.02.06	LE – SICS/PCIOL
13.	RANI	52/F	399415	LE – MC	17.02.06	LE – SICS/PCIOL
14.	ASHRAFUNISA	68/F	399442	BE-IMC R>L	22.02.06	RE – SICS/PCIOL
15.	AYISHA BEE	55/F	399961	BE-IMC R>L	09.03.06	RE – SICS/PCIOL
16.	SUNDARAMMA	65/F	400200	RE – MC	16.03.06	RE – SICS/PCIOL
17.	SAMSHUDIN	58/M	400474	RE – IMC	23.03.06	RE – SICS/PCIOL
18.	INDRANI	52/F	400576	RE – IMC	30.03.06	RE – SICS/PCIOL
19.	MUNIAMMAL	60/F	394493	RE-FUNGAL CORNEAL ULCER WITH HYPOPYON	22.06.05	RE-TKP 9MM OVER 8MM
20.	RAVI	17/M	25789	LE CHALAZION	21.05.05	LE – I & C
21.	KAVERI	37/F	27240	RE-PTERYGIUM	21.05.05	EXCISION
22.	RAJAMMAL	35/F	384392	LE-FUNGAL CORNEAL ULCER WITH HYPOPYON	20.06.05	LE – AC WASH WITH AMP – B
23.	MUNIAPPAN	59/M	83120	LE-PAN OPHTHALMITIS	26.11.05	LE-EVISCERATIONQ
24.	SHANTHI	52/F	376292	RE-ABSOLUTE GLAUCOMA	08.12.05	RE-CYCLOCRYO
25.	LAKSHMI	50/F	396830	RE-CHR. DACROCYSTITIS	07.02.06	RE DCT
26.	BABU	09/M	396857	RE-TRAUMATIC ENDOPHTHALMITIS	07.02.06	RE-INTRA VITREAL INJ. OF BR.SP.ANTBIOTICS
27.	MALAKONDIAH	55/M	387906	BE-SEC ACG		RECOMBINED SUR
28.	GIRIJA	45/F	402574	BE-PACG		RE-AG SURGERY
29.	SHANKAR	32/M	402574	RE-CHR. DACROCYSTITIS	08.05.06	RE – DCR
30.	JAIBUNISA	15/F	397265	RE-OLD RHEG.RD	16.06.06	RE-RD SURG (360º ENCIRCLAGE WITH CRYO WITH SRF DRAINAGE)

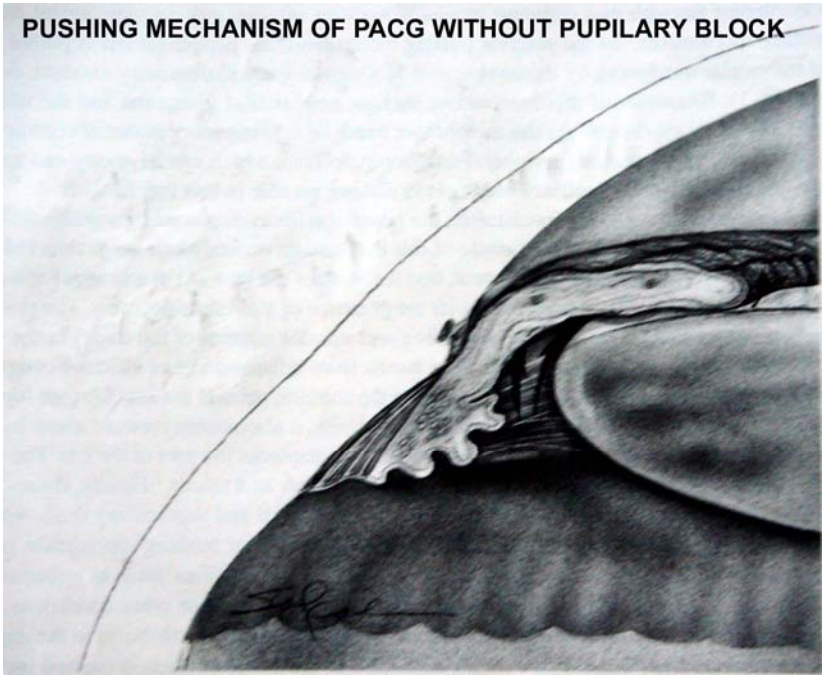
A – SCAN BIOMETRY

PACHYMETER

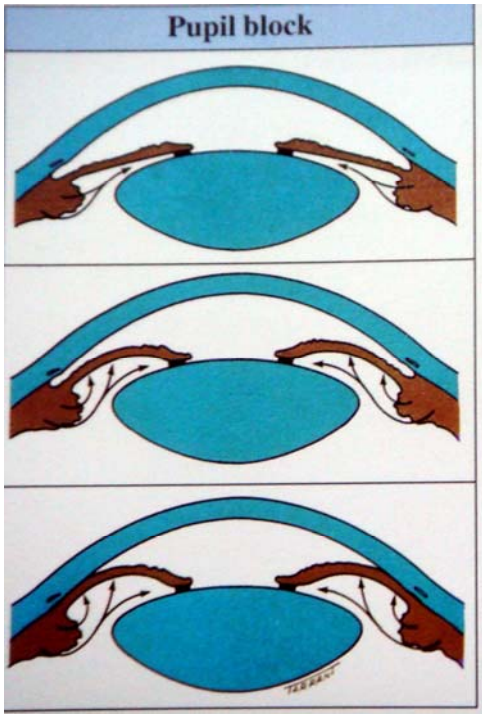

PATIENT DATA OCT 17,06 08:47:45
1.PATIENT .....
2.ID # .....
3.EYE EXAMINED ....
PRESS APPROPRIATE NUMERIC KEY:
PACHYMETER
SONOMED

PATHO PHYSIOLOGY OF PACG



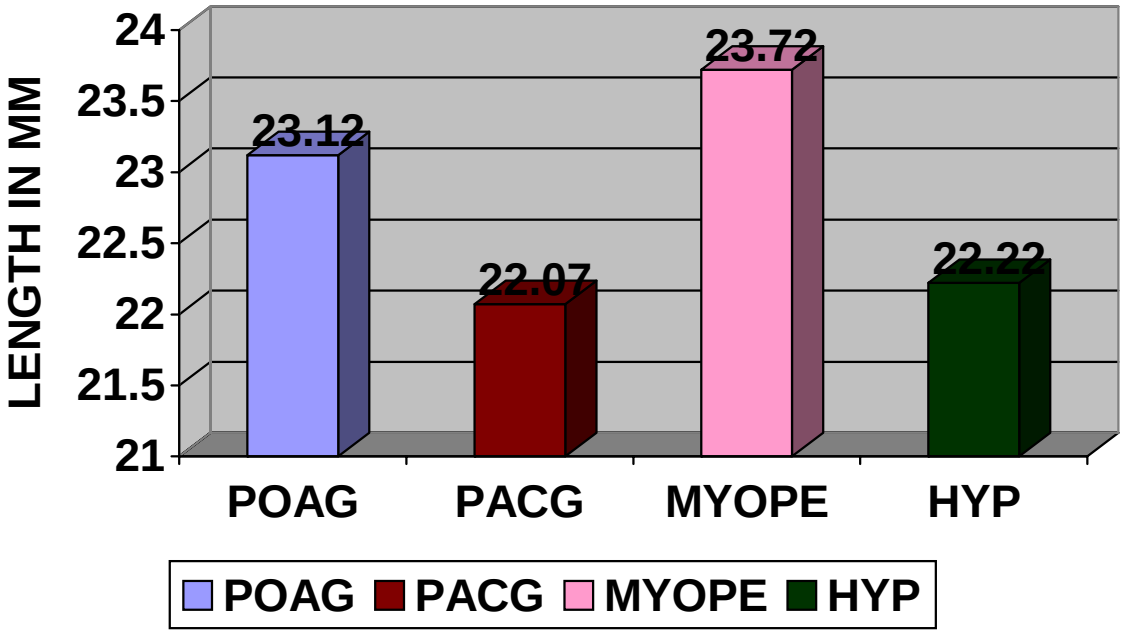


PUPILLARY BLOCK IN PACG

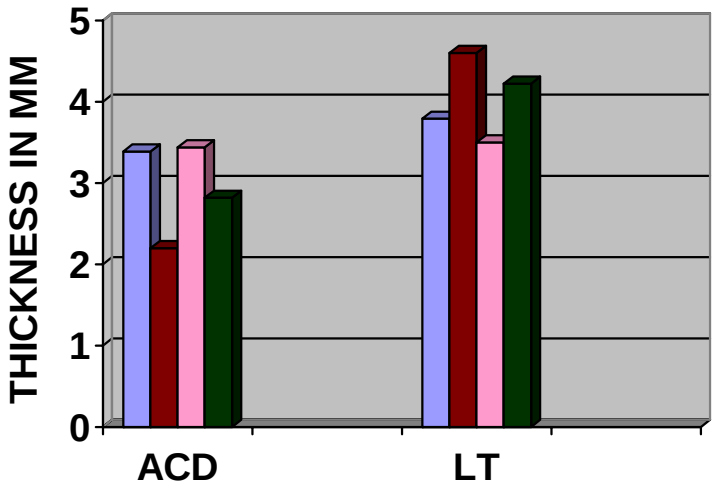


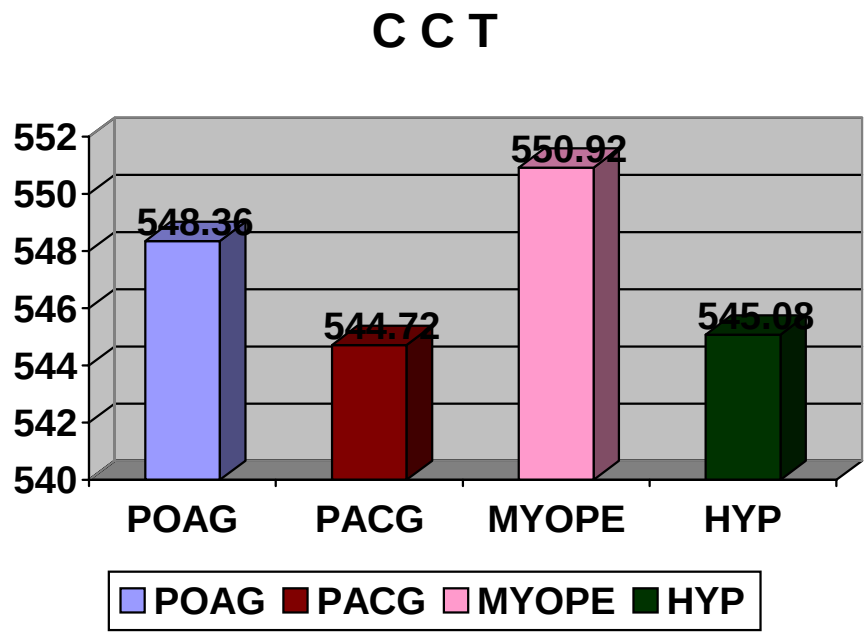
- Increase in physiological pupil block
- Dilatation of pupil renders peripheral iris more flaccid
- Increased pressure in posterior chamber causes iris bombé
- Angle obstructed by peripheral iris and rise in IOP

AXIAL LENGTH



ACD AND LT

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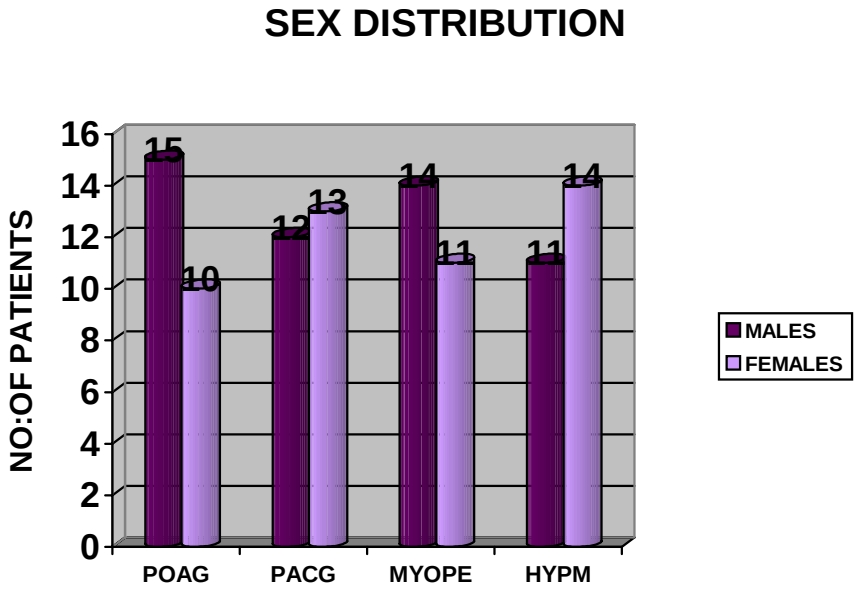
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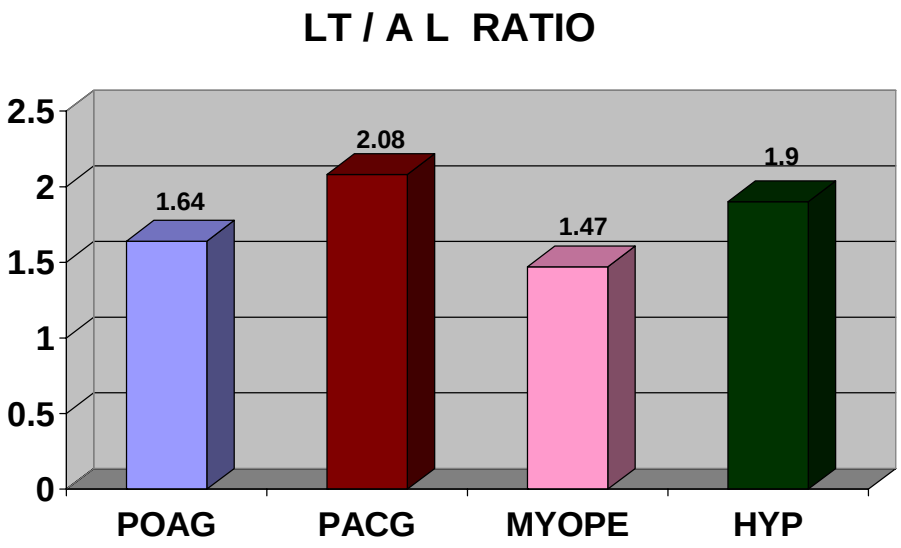
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HYPERMETROPES

S.NO	NAME	AGE	SEX	OP/IP	R Sph	R cyl	AXIS	V/A	IOP	CCT	ACD	LT	AL	LT/AL
1	ANTHONY	21	M	####	1.75	0.5	90	6 by 6	13	526	2.71	3.99	22.22	1.80
2	ANTHONY	21	M	####	1.5	0.75	90	6 by 6	14	516	2.85	4.00	22.25	1.80
3	ARUMUGAM	27	M	####	2			6 by 6	15	569	2.80	4.05	22.10	1.83
4	ARUMUGAM	27	M	####	1.5			6 by 6	16	568	2.86	4.26	22.05	1.93
5	ARUNA	23	F	####	1.75			6 by 6	12	524	2.86	4.27	22.41	1.91
6	ARUNA	23	F	####	1.75	0.75	90	6 by 6	14	528	2.87	4.29	22.36	1.92
7	ELAVARASI	27	F	####	2			6 by 6	16	529	2.85	3.95	22.25	1.78
8	ELAVARASI	27	F	####	1.75			6 by 6	15	535	2.89	4.05	22.27	1.82
9	GRACY	25	F	####	2.25			6 by 6	15	548	2.80	4.40	22.31	1.97
10	GRACY	25	F	####	2.5			6 by 6	12	532	2.67	4.48	22.12	2.03
11	HARI	25	M	####	2.5			6 by 6	14	563	2.72	4.33	22.25	1.95
12	HARI	25	M	####	1.75			6 by 6	13	580	2.89	4.43	22.32	1.98
13	JEEVA	30	M	####	1.5			6 by 6	12	510	2.90	3.95	22.31	1.77
14	JEEVA	30	M	####	1.75			6 by 6	14	508	2.82	4.14	22.22	1.86
15	JYOTHI	18	F	####	2.75			6 by 6	15	548	2.61	4.38	22.27	1.97
16	JYOTHI	18	F	####	2.5			6 by 6	15	537	2.79	4.39	22.18	1.98
17	KAMALA	28	F	####	2.75	0.5	90	6 by 6	16	533	2.97	4.02	22.26	1.81
18	KAMALA	28	F	####	2.75	0.5	90	6 by 6	14	531	2.79	4.03	22.25	1.81
19	LATHA	22	F	####	2.5			6 by 6	15	555	2.71	4.19	21.88	1.91
20	LATHA	22	F	####	2.75			6 by 6	13	545	2.89	4.33	21.98	1.97
21	LAVANYA	14	F	####	2.75			6 by 6	12	515	2.80	4.10	22.07	1.86
22	LAVANYA	14	F	####	1.5			6 by 6	14	520	2.95	4.21	22.08	1.91
23	MOHANA	26	F	####	1.5			6 by 6	15	540	2.85	4.24	22.24	1.91
24	MOHANA	26	F	####	2.5			6 by 6	13	550	2.92	4.43	22.33	1.98
25	MUNIAMMA	26	F	####	2.5			6 by 6	14	552	2.85	4.29	22.31	1.92
26	MUNIAMMA	26	F	####	2			6 by 6	14	533	2.92	4.35	22.06	1.97
27	PARIMALA	23	F	####	1.75			6 by 6	16	554	2.96	4.26	22.35	1.91
28	PARIMALA	23	F	####	1.5			6 by 6	14	564	2.85	4.30	22.46	1.91
29	PRAKASH	24	M	####	1.5			6 by 6	15	527	2.70	4.28	22.30	1.92
30	PRAKASH	24	M	####	1.25			6 by 6	13	528	2.54	4.36	22.29	1.96
31	PREMA	26	F	####	1.5			6 by 6	12	581	2.70	4.25	22.24	1.91
32	PREMA	26	F	####	1.5			6 by 6	15	582	2.76	4.46	22.33	2.00
33	PUNNIYAKODI	25	M	####	2.75			6 by 6	13	548	2.77	3.92	22.26	1.76
34	PUNNIYAKODI	25	M	####	2.75			6 by 6	14	547	2.88	4.08	22.01	1.85
35	RAJALINGAM	29	M	####	1.75			6 by 6	12	513	2.78	3.96	22.08	1.79
36	RAJALINGAM	29	M	####	1.5			6 by 6	15	504	2.85	4.09	22.26	1.84
37	RATHI	14	F	####	1.5	1	180	6 by 6	15	553	2.72	4.21	21.91	1.92
38	RATHI	14	F	####	1.5	1	180	6 by 6	13	557	2.72	4.26	21.99	1.94
39	SELVAM	21	M	####	1			6 by 6	13	550	2.83	4.26	22.24	1.92
40	SELVAM	21	M	####	1.25			6 by 6	15	535	2.84	4.36	22.07	1.98
41	SHANKAR	17	M	####	1.5			6 by 6	16	567	2.74	3.97	22.39	1.77
42	SHANKAR	17	M	####	1.25			6 by 6	14	560	2.88	4.14	22.46	1.84
43	SIVANANDAM	22	M	####	2.25			6 by 6	14	566	3.16	4.20	22.07	1.90
44	SIVANANDAM	22	M	####	2.5			6 by 6	15	552	3.14	4.28	22.17	1.93
45	SUBAIDA	29	F	####	2.5			6 by 6	13	530	2.62	4.29	22.18	1.93
46	SUBAIDA	29	F	####	2			6 by 6	14	525	2.82	4.34	22.29	1.95
47	THARANGINI	26	F	####	2.5	1	70	6 by 6	13	576	2.82	4.28	22.25	1.92
48	THARANGINI	26	F	####	2.5	1.5	110	6 by 6	15	582	2.72	4.33	22.37	1.94
49	VIVEK	27	M	####	2.25			6 by 6	14	574	2.73	4.35	22.39	1.94
50	VIVEK	27	M	####	2			6 by 6	13	584	2.74	4.36	22.31	1.95

POAG

S.NO	NAME (POAG)	AGE	SEX	OP/IP	VA	IOP	CCT	ACD	LT	AL	LT/AL
1	AMSA	43	F	35013	6 by 6	14	540	3.19	3.92	22.92	1.71
2	AMSA	43	F	35013	6 by 12p	15	542	3.07	4.03	22.84	1.76
3	BARATHIRAJA	47	M	35134	6 by 9	16	542	3.30	3.51	22.67	1.55
4	BARATHIRAJA	47	M	35134	6 by12	15	546	3.30	3.81	22.73	1.68
5	CHELLAPAN	37	M	40789	6 by 12	13	540	3.30	4.10	22.86	1.79
6	CHELLAPAN	37	M	40789	6 by 9	16	536	3.16	4.10	22.84	1.80
7	ELUMALAI	48	M	33345	6 by 6	16	504	3.48	3.50	22.77	1.54
8	ELUMALAI	48	M	33345	6 by 6 p	15	508	3.40	3.60	22.90	1.57
9	JAYANTHI	38	F	45678	6 by 6	14	569	3.45	3.63	23.14	1.57
10	JAYANTHI	38	F	45678	6 by12	16	563	3.40	3.75	23.11	1.62
11	JOHN	42	M	46342	6 by 9p	16	543	3.35	3.63	23.43	1.55
12	JOHN	42	M	46342	6 by 12	14	549	3.37	3.80	23.48	1.62
13	KOKILA	49	F	47812	6 by 6	15	524	3.72	3.61	23.85	1.51
14	KOKILA	49	F	47812	6 by12	15	526	3.72	3.61	23.85	1.51
15	MARGABANDU	45	M	34215	6 by 6p	17	536	3.30	3.72	22.86	1.63
16	MARGABANDU	45	M	34215	6 by 9	15	538	3.29	3.80	22.84	1.66
17	MARIAMMAL	45	F	39876	6 by12	14	520	3.40	3.85	22.68	1.70
18	MARIAMMAL	45	F	39876	6 by 6	14	540	3.18	3.90	22.81	1.71
19	PONNI	50	F	30000	6 by 12	17	607	3.17	3.92	23.46	1.67
20	PONNI	50	F	30000	6 by6	15	604	3.20	4.00	23.44	1.71
21	RAJATHI	42	F	31234	6 by 9	16	589	3.48	3.57	23.59	1.51
22	RAJATHI	42	F	31234	6 by 9	18	589	3.52	3.61	23.43	1.54
23	RAJENDRAN	36	M	36420	6 by 6	15	554	3.50	3.51	23.36	1.50
24	RAJENDRAN	36	M	36420	6 by 12	16	554	3.46	3.69	23.37	1.58
25	RAMANAN	44	M	41029	6 by 9	15	535	3.18	3.77	22.80	1.65
26	RAMANAN	44	M	41029	6 by 9	13	541	3.28	3.83	22.82	1.68
27	RAMZAN	31	F	48721	6 by 6p	14	547	3.35	4.05	22.95	1.76
28	RAMZAN	31	F	48721	6 by 12	15	537	3.25	4.05	22.85	1.77
29	RANI	42	F	45362	6 by6	14	507	3.49	4.00	23.57	1.70
30	RANI	42	F	45362	6 by 6	12	538	3.41	4.00	23.49	1.70
31	RANJITH	38	M	34444	6 by 9p	15	542	3.38	3.65	22.81	1.60
32	RANJITH	38	M	34444	6 by 12	13	540	3.37	3.80	22.87	1.66
33	RAVICHANDRAN	50	M	37676	6 by 6	15	600	3.08	3.64	23.39	1.56
34	RAVICHANDRAN	50	M	37676	6 by 12	15	598	3.10	3.80	23.63	1.61
35	SALEEM	49	M	32509	6 by 9	17	518	3.45	3.97	23.01	1.73
36	SALEEM	49	M	32509	6 by 6	14	546	3.50	4.02	23.09	1.74
37	SIDDIK	47	M	35987	6 by 6p	15	562	3.47	3.54	22.78	1.55
38	SIDDIK	47	M	35987	6 by 9	16	552	3.31	3.54	22.65	1.56
39	SUBHASINI	38	F	37874	6 by 12	14	590	3.66	3.85	23.22	1.66
40	SUBHASINI	38	F	37874	6 by12	16	593	3.52	3.87	23.28	1.66
41	SURESH	37	M	35656	6 by 6	18	545	3.92	3.54	23.35	1.52
42	SURESH	37	M	35656	6 by 12p	15	550	3.80	3.64	23.18	1.57
43	VADIVELU	40	M	40003	6 by 9	12	548	3.70	3.53	23.85	1.48
44	VADIVELU	40	M	40003	6 by 6	14	534	3.80	3.58	23.75	1.51
45	VALAIYAPATHI	49	M	32121	6 by 6	15	537	3.07	3.97	22.78	1.74
46	VALAIYAPATHI	49	M	32121	6 by 9	16	538	3.11	4.03	22.93	1.76
47	VASANTHI	33	F	30278	6 by 12	17	547	3.53	4.00	22.86	1.75
48	VASANTHI	33	F	30278	6 by 6	15	536	3.46	4.00	22.78	1.76
49	VENUGOPAL	34	M	45454	6 by 9	16	537	3.40	3.75	23.02	1.63
50	VENUGOPAL	34	M	45454	6 by 9	17	537	3.38	3.77	23.06	1.63

PACG

S.NO	NAME	AGE	SEX	OP/IP	VA	IOP	CCT	ACD	LT	AL	LT/AL
1	DHANALAKSHMI	49	F	36758	6 by 12	14	567	2.26	4.48	21.75	2.06
2	DHANALAKSHMI	49	F	36758	6 by 6	16	570	2.19	4.80	21.81	2.20
3	HAMSARANI	50	F	45325	6 by 9 p	15	536	2.16	4.63	22.30	2.08
4	HAMSARANI	50	F	45325	6 by 12	16	544	2.14	4.63	22.15	2.09
5	LAKSHMI	41	F	34254	6 by 6	14	562	2.07	4.65	21.77	2.14
6	LAKSHMI	41	F	35254	6 by6	11	560	2.17	4.66	21.81	2.14
7	MANIVEL	38	M	44335	6 by12p	14	526	2.09	4.47	21.85	2.05
8	MANIVEL	38	M	44335	6 by 9 p	13	525	2.08	4.69	21.82	2.15
9	MATHI	32	M	41129	6 by12p	15	569	2.10	4.67	22.19	2.10
10	MATHI	32	M	41129	6 by 6	16	568	2.30	4.69	22.10	2.12
11	MD BIBI	50	F	34544	6 by 12	13	507	2.05	4.58	21.79	2.10
12	MD BIBI	50	F	34544	6 by 6	15	511	2.15	4.61	22.04	2.09
13	MEERA	39	F	43697	6 by 12	16	558	2.09	4.52	21.81	2.07
14	MEERA	39	F	43697	6 by 12	16	564	2.05	4.71	21.79	2.16
15	MOHAN	50	M	37765	6 by 9 p	17	495	2.50	4.57	22.26	2.05
16	MOHAN	50	M	37765	6 by 12	18	520	2.60	4.69	22.20	2.11
17	MURALI	35	M	37658	6 by 6	14	537	2.20	4.53	22.31	2.03
18	MURALI	35	M	37658	6 by 9	15	543	2.20	4.54	22.18	2.05
19	MUTHU	46	M	32986	6 by 12	15	512	2.19	4.39	22.30	1.97
20	MUTHU	46	M	32986	6 by 9	16	515	2.22	4.49	22.28	2.02
21	PRIYA	31	F	34576	6 by 6	17	565	2.00	4.52	22.06	2.05
22	PRIYA	31	F	34576	6 by 9p	15	561	2.02	4.59	22.17	2.07
23	PUGAZHENDI	42	M	45676	6 by12	13	602	2.43	4.64	22.25	2.09
24	PUGAZHENDI	42	M	45676	6 by 12	12	603	2.38	4.69	22.15	2.12
25	RAJAN	48	M	45345	6 by 6	11	580	2.26	4.64	21.86	2.12
26	RAJAN	48	M	45345	6 by 6p	14	579	2.29	4.84	22.08	2.19
27	RAJESWARI	40	F	36756	6 by 9p	18	536	2.24	4.61	22.17	2.08
28	RAJESWARI	40	F	36756	6 by 6	16	529	2.16	4.66	22.20	2.10
29	RAMZAN BEE	34	F	30987	6 by 6	15	526	2.22	4.63	22.10	2.10
30	RAMZAN BEE	34	F	30987	6 by 9	15	525	2.25	4.64	22.10	2.10
31	ROJA	38	F	43509	6 by12	12	510	2.26	4.37	22.19	1.97
32	ROJA	38	F	43509	6 by 12	14	508	2.19	4.67	21.72	2.15
33	SARASWATHI	47	F	45562	6 by 12	13	500	2.25	4.61	22.17	2.08
34	SARASWATHI	47	F	45562	6 by 9	15	497	2.35	4.63	22.20	2.09
35	SATHYAMOORTHI	45	M	37685	6 by 6	15	580	2.28	4.52	22.12	2.04
36	SATHYAMOORTHI	45	M	37685	6 by 6p	12	596	2.04	4.54	22.26	2.04
37	SHANKAR	34	M	43523	6 by 12p	16	623	2.22	4.66	22.15	2.10
38	SHANKAR	34	M	43523	6 by 6	17	612	2.43	4.73	22.01	2.15
39	SHANTHI	48	F	34276	6 by12	15	533	1.98	4.47	22.09	2.02
40	SHANTHI	48	F	34276	6 by 9	18	539	2.15	4.62	21.80	2.12
41	SOMU	42	M	36758	6 by 12p	17	559	2.03	4.62	22.21	2.08
42	SOMU	42	M	36758	6 by 9	15	563	2.16	4.73	22.00	2.15
43	SRINIVASAN	42	M	35625	6 by 6	17	520	2.20	4.65	21.95	2.12
44	SRINIVASAN	42	M	35625	6 by 6	16	512	2.29	4.75	21.84	2.17
45	SUNDARAMOORTH	45	M	34524	6 by 12	17	513	2.34	4.35	22.23	1.96
46	SUNDARAMOORTH	45	M	34524	6 by 6	15	514	2.17	4.40	22.22	1.98
47	VIDYA	32	F	34519	6 by 12	12	545	2.13	4.65	22.11	2.10
48	VIDYA	32	F	34519	6 by 9	13	540	2.01	4.69	22.30	2.10
49	VIMALA	48	F	36924	6 by 9p	14	544	2.18	4.25	22.00	1.93
50	VIMALA	48	F	36924	6 by 6	13	533	2.13	4.42	22.17	1.99

MYOPES

S.NO	NAME	AGE	SEX	OP/IP	R Sph	R cyl	AXIS	V/A	IOP	CCT	ACD	LT	AL	LT/AL
1	AMIT RAJ	19	M	38493	-3			6 by 6	12	546	3.40	3.51	23.93	1.47
2	AMIT RAJ	19	M	38493	-3.5			6 by 6	10	534	3.38	3.54	24.05	1.47
3	BADRI	16	M	36985	-3.5			6 by 6	13	546	3.45	3.34	24.01	1.39
4	BADRI	16	M	36985	-4			6 by 6	11	525	3.38	3.59	24.09	1.49
5	BALAMURUGAN	15	M	38518	-1.75	-0.8	180	6 by 6	13	541	3.68	3.27	23.55	1.39
6	BALAMURUGAN	15	M	38518	-1.75	-0.8	180	6 by 6	14	552	3.58	3.48	23.42	1.49
7	BEER MD	16	M	36830	-2			6 by 6	15	562	3.62	3.33	23.97	1.39
8	BEER MD	16	M	36830	-3.75			6 by 6	13	572	3.77	3.47	23.96	1.45
9	DIVYA	15	F	51175	-3.5			6 by 6	16	534	3.59	3.49	23.76	1.47
10	DIVYA	15	F	51175	-2.5			6 by 6	18	530	3.33	3.60	23.64	1.52
11	GANGADEVI	16	F	37182	-2.5			6 by 6	11	605	3.34	3.81	23.96	1.59
12	GANGADEVI	16	F	37182	-1.25			6 by 6	14	573	3.28	3.96	23.93	1.65
13	JANANI	15	F	37226	-1.5			6 by 6	12	582	3.55	3.47	23.51	1.48
14	JANANI	15	F	37226	-3.5			6 by 6	11	574	3.43	3.49	23.46	1.49
15	JOTHI	29	F	33251	-2.75	-0.5	180	6 by 6	17	532	3.37	3.60	23.51	1.53
16	JOTHI	29	F	33251	-3.75	-0.5	180	6 by 6	15	522	3.17	3.66	23.40	1.56
17	LOGESWARI	22	F	31525	-3.5			6 by 6	14	561	3.29	3.44	23.65	1.45
18	LOGESWARI	22	F	31525	-2.25			6 by 6	15	542	3.46	3.52	23.71	1.48
19	NASREEN MD	16	F	41269	-2.5			6 by 6	15	536	3.36	3.39	23.96	1.41
20	NASREEN MD	16	F	41269	-2.75			6 by 6	16	550	3.46	3.52	23.96	1.47
21	PADMALAKSHMI	20	F	41797	-2.75	-0.8	180	6 by 6	14	543	3.26	3.44	23.95	1.44
22	PADMALAKSHMI	20	F	41797	-1.75	-0.5	180	6 by 6	17	550	3.28	3.44	23.90	1.44
23	PARTHASARATHY	17	M	36973	-1.75			6 by 6	16	546	3.63	3.28	23.95	1.37
24	PARTHASARATHY	17	M	36973	-2.5			6 by 6	14	555	3.43	3.55	23.90	1.49
25	PRADEEP	16	M	36900	-3.25			6 by 6	16	554	3.65	3.35	24.05	1.39
26	PRADEEP	16	M	36900	-4.75			6 by 6	14	521	3.61	3.44	24.11	1.43
27	RAJENDRAN	16	M	37333	-0.75	-0.5	180	6 by 6	12	554	3.69	3.26	23.67	1.38
28	RAJENDRAN	16	M	37333	-1.75			6 by 6	14	554	3.52	3.31	23.66	1.40
29	RATHISH	17	M	42487	-1.75			6 by 6	12	530	3.36	3.43	23.61	1.45
30	RATHISH	17	M	42487	-1.25			6 by 6	12	524	3.43	3.58	23.60	1.52
31	ROHINI	15	F	41470	-1.75	-0.5	160	6 by 6	17	564	3.43	3.60	23.57	1.53
32	ROHINI	15	F	41470	-1.5	-0.5	20	6 by 6	16	554	3.41	3.70	23.45	1.58
33	SAMUEL	15	M	38100	-3			6 by 6	13	590	3.65	3.28	23.87	1.37
34	SAMUEL	15	M	38100	-1.75			6 by 6	14	602	3.68	3.34	23.93	1.40
35	SELVAM	28	M	36932	-1.5	-0.8	110	6 by 6	17	555	3.19	3.52	23.57	1.49
36	SELVAM	28	M	36932	-1.5	-0.5	70	6 by 6	15	552	3.12	3.52	23.49	1.50
37	SELVI	22	M	39507	-1.5			6 by 6	14	524	3.13	3.60	23.55	1.53
38	SELVI	22	M	39507	-2.75			6 by 6	12	526	3.23	3.64	23.58	1.54
39	SENTHIL	24	M	36820	-2.75			6 by 6	12	545	3.49	3.51	23.66	1.48
40	SENTHIL	24	M	36820	-1.75			6 by 6	12	531	3.52	3.65	23.61	1.55
41	SIDDIQUE	17	M	44865	-1.5			6 by 6	16	552	3.31	3.54	23.50	1.51
42	SIDDIQUE	17	M	44865	-2.5			6 by 6	15	568	3.31	3.54	23.50	1.51
43	SUDHA	14	F	39139	-2.25	-1	180	6 by 6	12	557	3.41	3.39	23.61	1.44
44	SUDHA	14	F	39139	-2.5	-1	180	6 by 6	16	546	3.29	3.59	23.72	1.51
45	SUGANYA	16	F	35158	-2.25			6 by 6	14	546	3.68	3.48	23.67	1.47
46	SUGANYA	16	F	35158	-1.5	-0.8	90	6 by 6	13	542	3.68	3.58	23.62	1.52
47	VIJAY	25	M	40873	-3.5			6 by 6	16	562	3.50	3.44	23.62	1.46
48	VIJAY	25	M	40873	-2.75			6 by 6	18	570	3.52	3.49	23.64	1.48
49	VIJAYAKUMARI	22	F	37312	-2.25			6 by 6	16	554	3.50	3.43	23.50	1.46
50	VIJAYAKUMARI	22	F	37312	-2	-0.5	90	6 by 6	17	556	3.30	3.46	23.50	1.47